

INVENTOR

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TITLE OF THE INVENTION

VISIBILITY ENHANCEMENT SYSTEM FOR A CNC MACHINE CENTER

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This patent application claims the priority of provisional application number 60/226,021 filed August 18, 2000.

BACKGROUND OF THE INVENTION

The invention relates to a CNC machine center and more specifically to a visibility enhancement system that allows the inner surface of a window in a door to be periodically wiped clean thereby allowing a person on the outside of the door to view the machining operations taking place inside the CNC machine center.

Modern machinery used in the metal removal areas of manufacturing, especially CNC machine centers are automated, enclosed machines that require the operator to be outside the machine enclosure during operation. These machines commonly have enclosures around the working area for a number of reasons: 1) safety, to protect the operator. Also the machines have electrical interlocks to restrict the machine from running in an automatic or full speed mode while the doors to the enclosure are not completely closed. 2) These machines typically have a coolant or lubricant flooding the work area during operation to lubricate and cool the cutting tool and to wash chips away from the cutting area as well.

The enclosure of these machine tools have windows in the walls of the enclosure to allow the operator to view inside the enclosure while the machine is running. The windows become covered with splashing coolant, which is typically water-soluble oil with a milky appearance, while running. The coolant splashing on the windows makes it difficult if not impossible to see what is happening in the interior of the machine while running. There is a need at times to be able to see what is happening inside of the enclosure while the machine is running. Without the ability to see inside, there are a number of things which can go wrong that could result in broken tools, scraped

parts, or damaged machines or fixtures. Any of these could be costly, and should be avoidable.

Presently, one mechanical device that allows the operator to see past the coolant on the interior side of the window is a "spin disc," or sometimes called a "Visiport." The spin disc is a circular glass or a plastic wheel mounted about an axle and powered by either an electric or pneumatic motor. The disc rotates at a high enough RPM to spin coolant off, giving the appearance of a clear window. The spinning disc is used in other applications including marine use to clear fog, rain, or saltwater spray from the cockpit windows of ships, and has been in existence for marine use since 1938, from Speich, an Italian Company located in Genoa, Italy.

"This Visiport" is believed to be from a German Company, and is distributed for manufacturer for machine tool use in the U.S. by Tooling 2000 located in Redmond, Washington. The Visiport type of product is limited in size by the diameter of the disc and the rotating masks. They are believed to be available only in 20 and 25-cm diameters. These products are very expensive. The disadvantages of a spin disc are: purchase cost, cost of installation for retrofit applications (this could involve interfacing with the machine control systems), and power consumption of either compressed air or electricity.

The second prior art type of device is an air blast. This is a nozzle spraying compressed air at the window. The drawbacks to this are the limited area that the stream of high-pressure air, approximately 100 psi, will cover, as well as the expense of compressed air consumption with an open nozzle for the time it would be blasting the window.

It is an object of the invention to provide a novel visibility system for a CNC machine center that is relatively inexpensive.

It is also an object of the invention to provide a novel visibility system for a CNC machine

center that is easily and quickly installed..

It is another object of the invention to provide a novel visibility system for a CNC machine center that requires no retrofit applications involving the machines control system.

It is an additional object of the invention to provide a novel visibility system for a CNC machine center that requires neither a power consumption of either compressed air nor electricity.

It is a further object of the invention to provide a novel visibility system for a CNC machine center that requires only a minimal number of small holes to be formed in the door to mount a manually operable windshield wiper assembly.

SUMMARY OF THE INVENTION

The invention is a cost-effective means of temporarily clearing the coolant from the inside of the windows. It's cost is considerably lower than spin discs both in the initial investment and in installation. The invention consists of a windshield wiper assembly having a wiper blade, a windshield wiper arm, a spindle and spindle housing, and a crank arm for causing the spindle to rotate. The spindle housing is mounted through the wall of the CNC machine center in an aperture or apertures created during the installation process. The spindle housing is then connected to the enclosure wall with a fastener or fasteners.

The spindle mounts inside the spindle housing in a pair of opposed anti-friction devices, and is free to rotate about its axis. At one end of the spindle on the interior of the machine is an arm attached at one end in a nonrotatable manner. This arm has a windshield wiper arm mounted to its opposite end. The windshield wiper arm is free to rotate about one axis, which is perpendicular to the longitudinal axis of the arm. This allows the wiper to float, compensating for

angular misalignment between the longitudinal axis of the arm and the interior surface of the window. The wiper blade will lay flat, contacting the window for its entire length. The wiper blade is made of a soft material, which will scrape across the surface of the window as the spindle is rotated and displace the liquid, which may obscure visibility into the machine.

In operation, the operator will hold the knob on the end of the crank arm in one hand and cause the spindle to rotate a variable number of degrees causing the windshield wiper arm and wiper blade to move back and forth across the window as may be required to displace the liquid and observe the interior of the machine during operations.

DESCRIPTION OF THE DRAWINGS

Figure 1 is a front perspective view of a CNC machine center illustrating a door having a viewing window and showing the windshield wiper assembly installed on the door;

Figure 2 is a front perspective view of the windshield wiper assembly as assembled but having the door removed for clarity;

Figure 3 is an exploded side elevation view of the windshield wiper assembly with portions broken away for clarity; and

Figure 4 is a cross-sectional view along lines 4-4 of Figure 2 illustrating the cylindrically-shaped spindle housing.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The visibility enhancement system for a CNC machine center will now be described by referring to Figures 1-4 of the drawings. The CNC machine center is generally designated

numeral 10. It has a console 12, a CNC cutting machine 14, a door 16 and a door 18. Door 18 has a window 20 and a handle 22. Window 20 has a peripheral edge 24 having a top edge 25, a bottom edge 26, a left edge 27 and a right edge 28. A windshield wiper assembly 30 is mounted adjacent the intersection of top edge 25 and left edge 27.

The structure of the windshield wiper assembly 30 and the manner in which it is mounted on door 18 is best understood by referring to Figures 2-4. It has an elongated spindle or shaft 32 having a crank arm 33 secured to its front end. A knob 34 is secured to crank arm 33. The rear end of spindle 32 has a pair of diametrically opposed flat sections 36 that are interspersed by external threads 37. A snap ring groove 38 is located intermediate the length of spindle 32. The function of these elements will be described later.

A cylindrically-shaped spindle housing has a flange 41 adjacent its front end having ring-shaped flange portions 43 and 44. The wing-shaped flange portions 43 and 44 have respective apertures 45 and 46 passing therethrough. Cylindrically-shaped spindle housing 40 has a diameter D1 and a neck portion 50. It has a bushing 52 having a bore hole 53. Spindle 32 is journaled in bushing 52 so that it rotates freely. Spindle housing 40 is installed in door 18 by drilling a hole from its outer surface all the way through to its inner surface. This hole would have a diameter slightly larger than D1 so that it is easily insertable therein. Laterally spaced holes would be drilled through door 18 to align with the apertures 45 and 46 in flange 41. Washers 55 and nuts 56 would be screwed onto the ends of a screws 57 to keep spindle housing 40 stationary and prevent spindle housing 40 from rotating. A flat washer 58 is inserted over the rear end of spindle 32 as it passes through spindle housing 40 and a snap ring 60 would be inserted into snap ring groove 38. The rear end of spindle 32 also passes through a bore hole 62 in a tapered splined

1 sleeve 61 that internal is diametrically opposed flat surface areas 64 that mate with the flat
2 portions 36 on spindle 32 so that rotation of spindle 32 also causes rotation of tapered splined
3 sleeve 61. Spindle arm 66 has a splined bore 68 that mates with the splines on the outer surface
4 of tapered spine sleeve 61. Spindle arm 66 also has a bore hole in its rear end that allows the
5 front end of spindle 32 to pass therethrough and a lock washer 68 and a castle nut 69 are screwed
6 on to its end.

7 A pivot pin 71 secures windshield wiper arm 73 to spindle arm 66. A coil spring 74 has its
8 one end captured by a pin 75. The opposite end of coil spring 74 is secured to a link 77 whose
9 other end is secured to spindle arm 66 and that applies a spring tension causing the windshield
10 wiper arm 73 to be pressed against the inner surface of window 20. A length adjustment arm 80
11 can have its length adjusted by locking lever 82 so that different lengths of wiper blades can be
12 utilized. A bracket 84 is mounted adjacent the front end of adjustable length arm 80 and it has
13 diametrically opposed apertures 85 that receive pins 86 extending outwardly from blade frame 88
14 that holds the wiper blade 90.

15 Figure 1 shows that window 20 has a film of lubricants and machine cuttings sprayed
16 against its inner surface. The path of wiper blade 90 over the inner surface of window 20 shows
17 how the visibility is dramatically improved thereby allowing a person on the outside of door 18 to
18 view the machining operations in the CNC machine center. A person can continually crank arm
19 33 up and down through an angle A that is approximately 90° to provide a clear area on the
20 inside surface of the window. It is understood that a D.C. motor or a pneumatic motor could be
21 utilized to reciprocally rotate spindle 32 back and forth through the predetermined angle A.